

Phycoremediation of Landfill Permeate: Microalgae vs Filamentous Algae

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Introduction

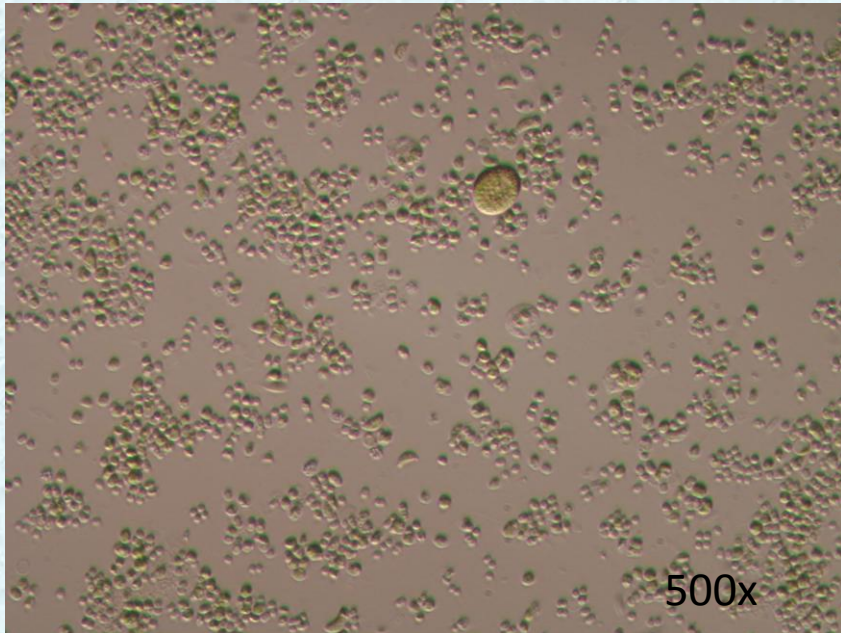
- Groundwater is a precious resource that is decreasing rapidly around the world, which emphasizes the need to remediate water.
- There are thousands of landfills in the United States that are all producing leachate, which must be remediated.
- Alachua County SW landfill (ACSWL) is currently using an experimental two phase reverse osmosis system to remediate leachate.
 - The product from the first phase will be referred to as permeate.

Algal remediation

- Algae show promise in sustainable waste water remediation.
 - Landfill leachate needs sustainable treatment methods
- One of the problems with using algae is that it is difficult to harvest the algae.
 - Harvesting increases cost of treatment
- Algae come in all shapes and sizes:
 - Filamentous algae may improve harvesting and therefore sustainability

Morphology of Native Algae

Microalgae (Native polyculture)



Filamentous Algae
(*Rhizoclonium* sp.)



Hypothesis

- Filamentous algae will provide ammonia remediation of landfill permeate equal to that of microalgae.

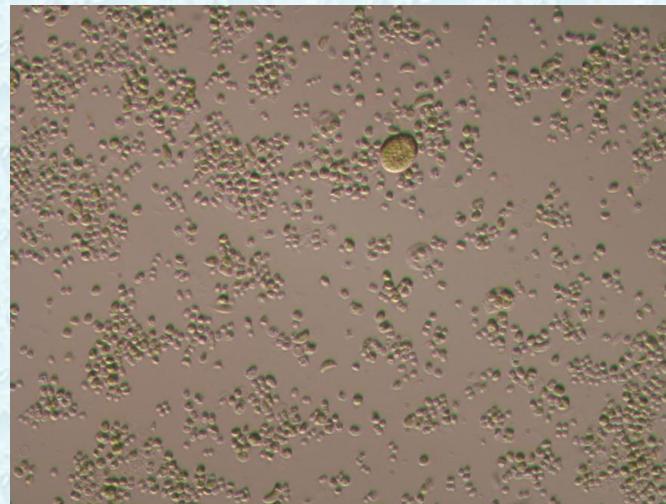
Objectives

1. Demonstrate the ability of filamentous algae and microalgae to remediate permeate.
2. Show that filamentous algae can provide the same or increased remediation as microalgae.

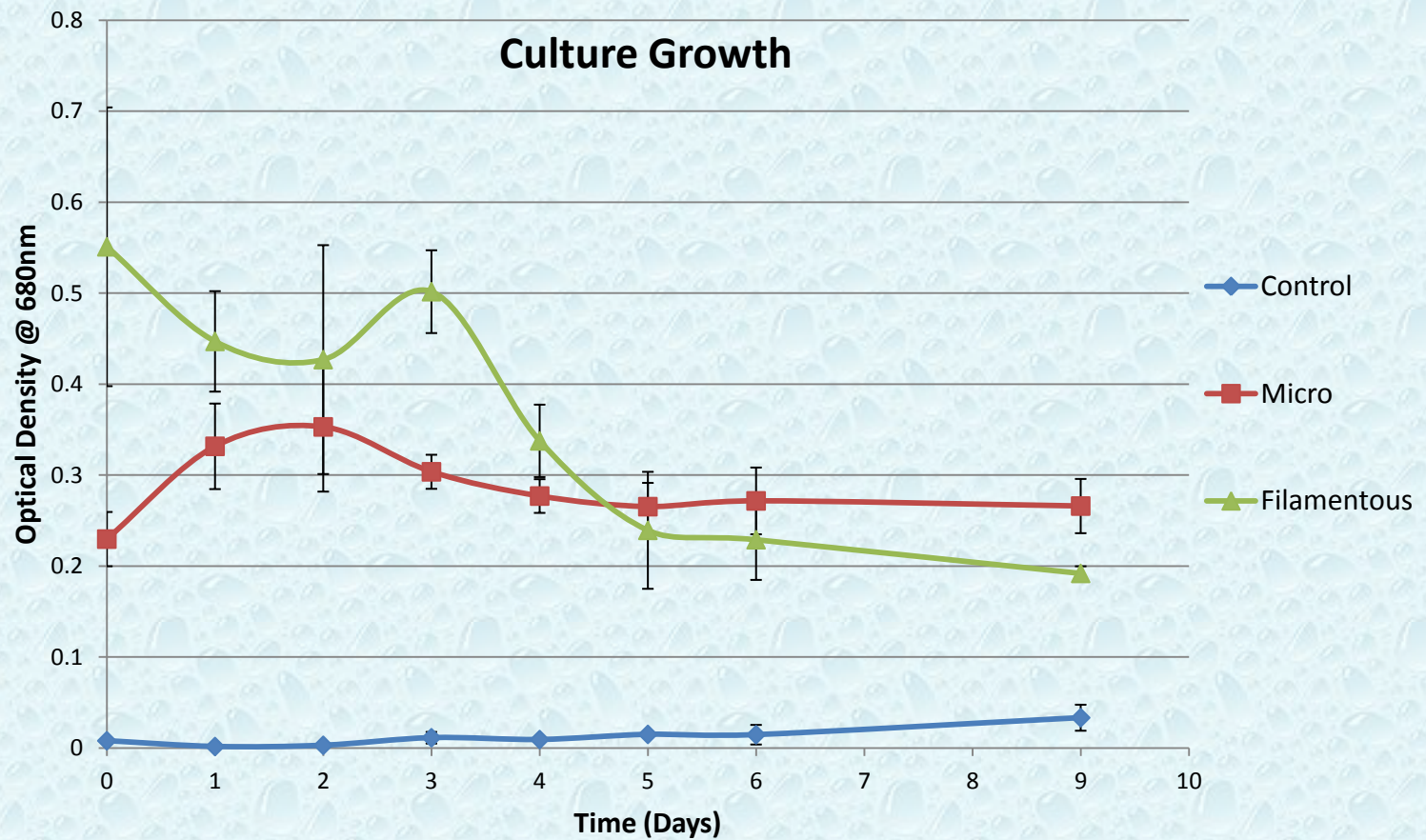
Methodology

- Triplicate experiments were setup in flasks to compare the remediation of micro and filamentous algae.
- All of the experimental groups were placed on an orbital shaker at 145 rpm, under 12:12 illumination at $150\mu\text{E}/\text{m}^2/\text{s}$.

Experimental Setup



Preliminary Results



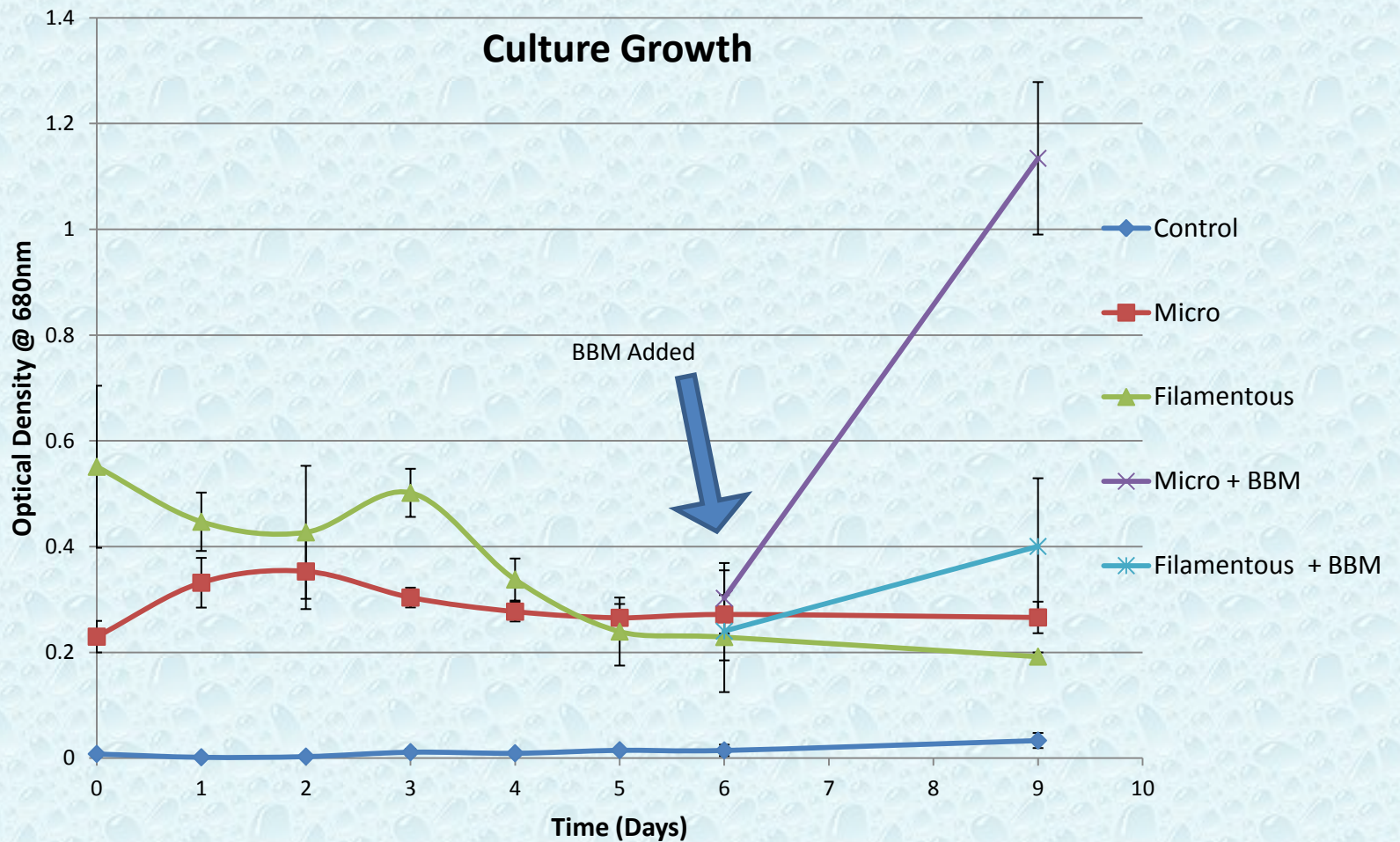
Methodology

- After hypothesizing that the algae were being nutrient limited, the two experimental groups were split in half.
 - Algae on average are made up of approximately 1% phosphorus.
 - The RO permeate contains approximately 0.1 mg/L
 - A 10% addition of Bold's Basal Medium (BBM) was added to half of the experimental groups.
 - BBM is a widely used freshwater algae medium.

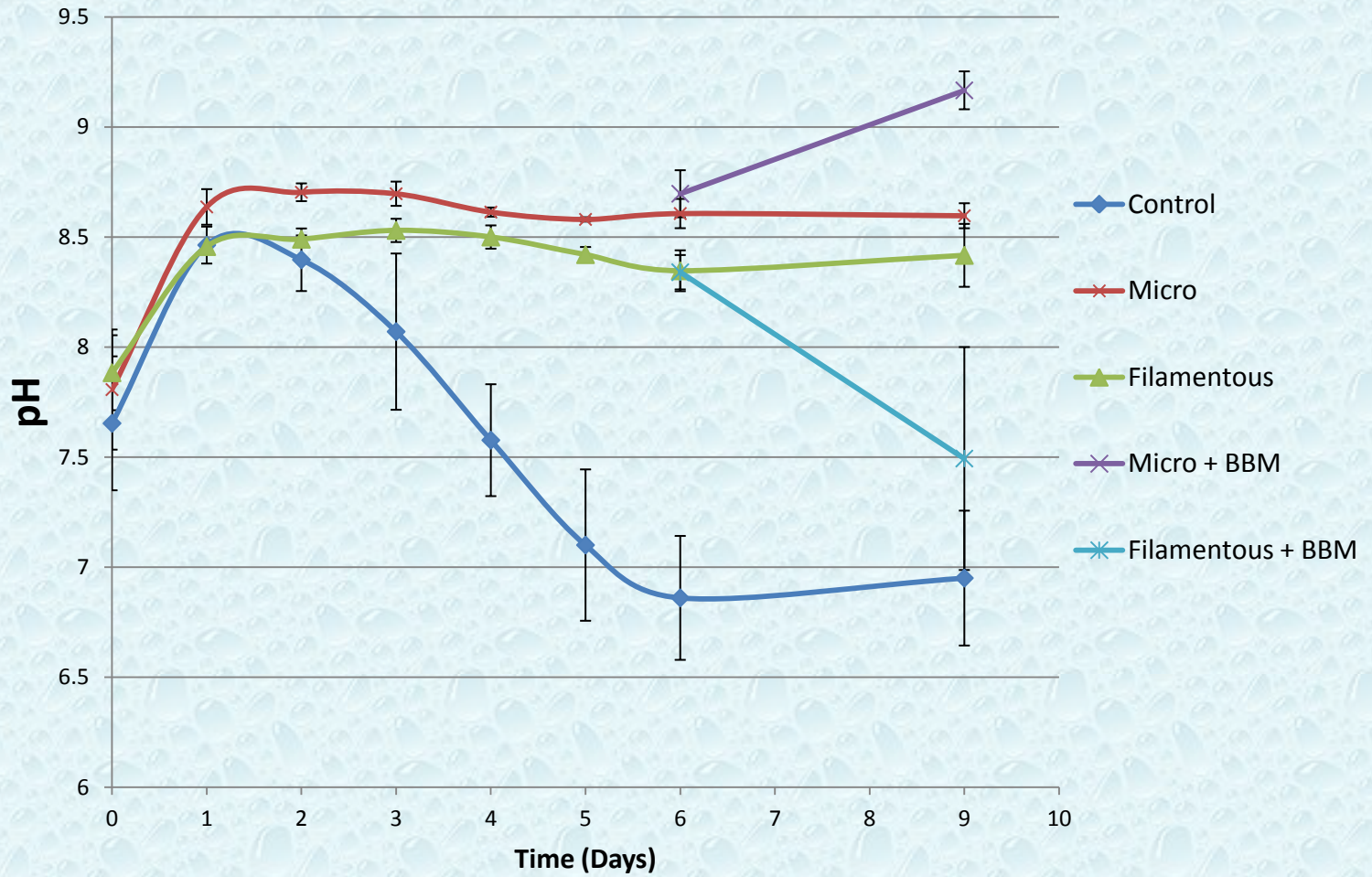
Methodology

- Daily tests were completed to observe the following parameters:
 - Ammonia
 - pH
 - Conductivity
 - Optical Density

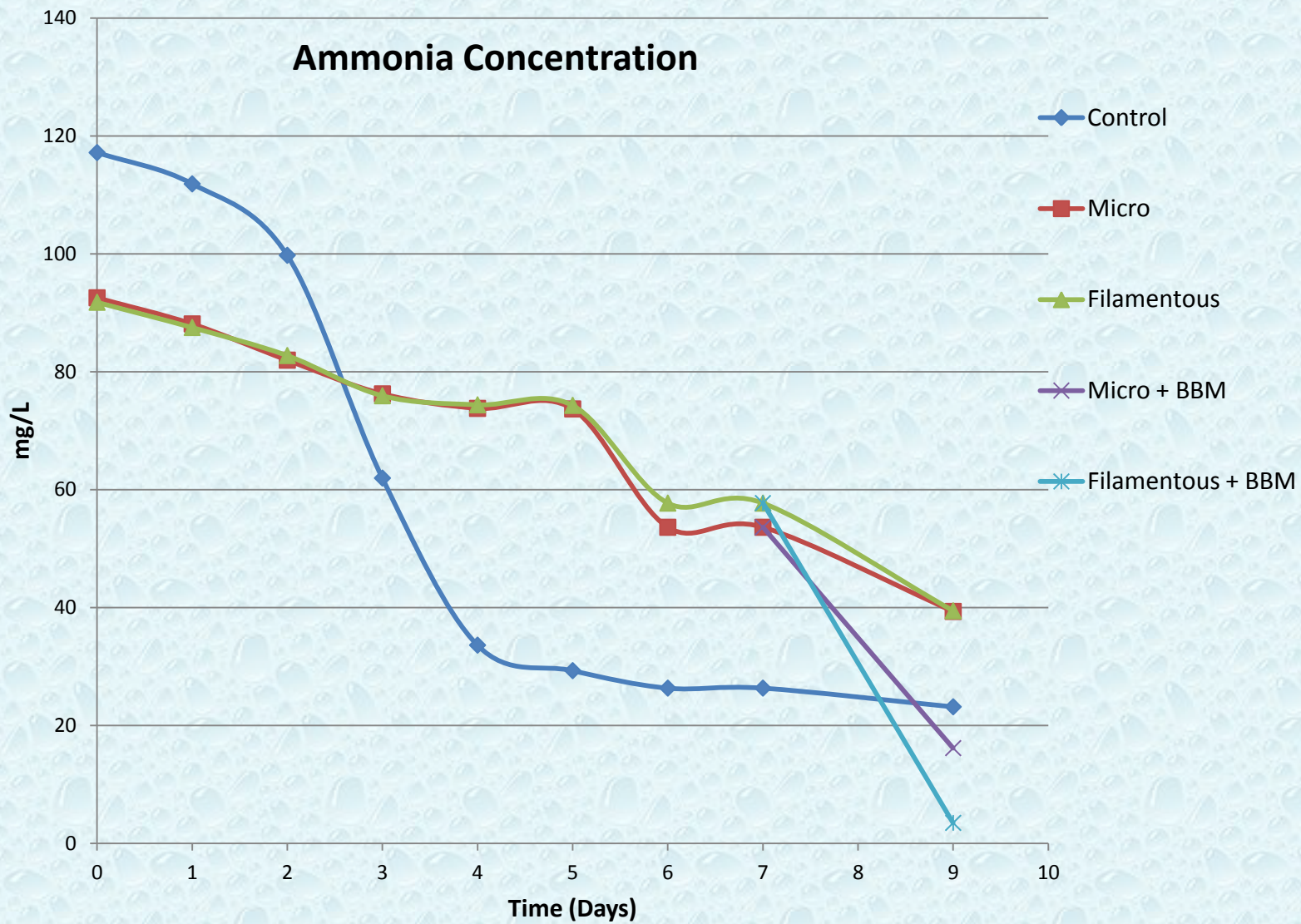
Results



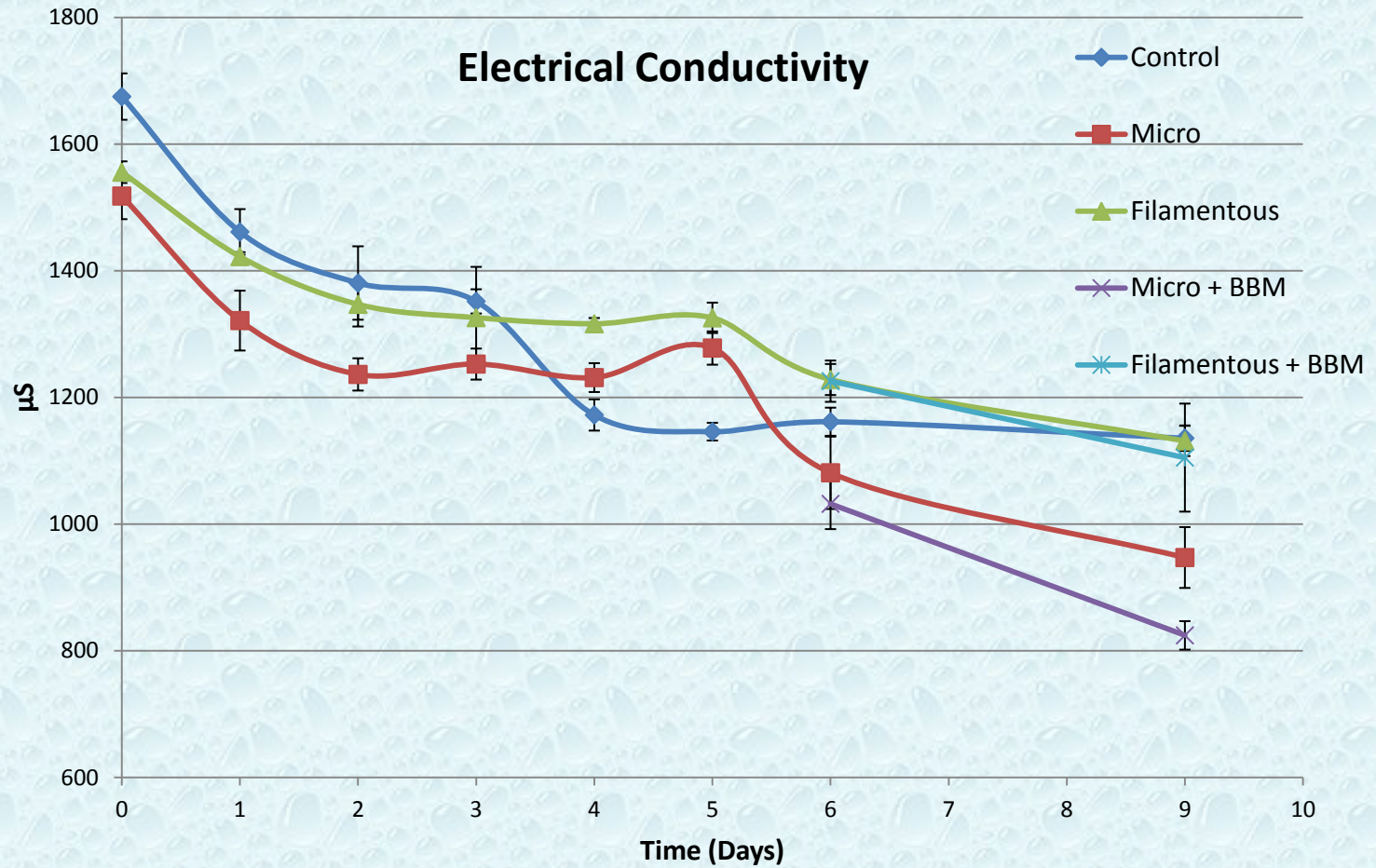
Results



Results



Results



Conclusions

- The RO permeate is limiting the growth of the algae due to a nutrient limitation.
- Growth limitation of algae limits remediation capacity.
- Algae need complete nutrition for effective remediation.

Future Studies

- Investigate alternative methods of pre-treating landfill leachate in order to increase the effectiveness of algal remediation.
- Further test the viability of utilizing filamentous algae to remediate landfill leachate.



References

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- FAO (2009). Algae-Based Biofuels: A Review of Challenges and Opportunities for Developing Countries. Food and Agricultural Organization of the United Nations, Rome, Italy.
- Richmond, Amos (1986). *Handbook of Microalgal Mass Culture*. CRC Press Boca Raton, Florida.